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Forest Pest Management
Pacific Northwest Region

ROOT DISEASE EVALUATION

SOUTH SIDE OF SAUK MOUNTAIN

MT. BAKER RANGER DISTRICT

MT. BAKER-SNOQUALMIE NATIONAL FOREST

WASHINGTON

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Root Disease Evaluation, South Side of Sauk Mountain, Mt. Baker Ranger District, Mt. Baker-Snoqualmie National Forest, Washington

by

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Summary

A 600-acre Douglas-fir-western hemlock-western redcedar stand on the south side of Sauk Mountain was surveyed for root diseases. About 3 percent of the area was found to be affected by *Phellinus weirii*, cause of laminated root rot. Over 10 percent of the area was involved in windthrow and mortality not associated with root disease. Favoring or planting cedar in root-diseased areas is recommended to reduce losses in future stands.

Introduction

At the request of the Mt. Baker Ranger District following a preliminary examination by Don Goheen, Pathologist, from the Forest Pest Management Staff (see Technical Assistance, Mt. Baker-Snoqualmie National Forest, May 26, 1982), we surveyed approximately 600 acres on the south side of Sauk Mountain (T. 35 N., R. 9 E., secs. 23 and 24, Figure 1). This area contains the proposed Bug Blowdown Sale Area and several future sales. The lower portion of the area contains a mixture of western redcedar *(Thuja plicata)*, western hemlock (*Tsuga heterophylla*), and Douglas-fir *(Pseudotsuga menziesii)*, with the latter species predominating. Western hemlock becomes more common as elevation increases. Pacific silver fir *(Abies amabilis)* is present at the uppermost end of the area. The lower and eastern portions of the area are composed chiefly of old-growth timber with several magnificent stands. The upper and western portions contain mostly second-growth hemlock stands which are now largely stagnated and have formed "doghair thickets." Topography ranges from rolling in the western portion to extremely steep in the eastern half.

Objectives

1. Locate and map all large (5 acre +) root disease centers along transects across the area.

2. Determine percent of area affected by root diseases.

3. Formulate treatment recommendations based on the survey data.

Methods

A line-intercept survey as modified from Bloomberg and others (1980) was used to determine percent of area affected by root diseases. Transects were intended to be established at 10-chain intervals across the area, but this was not always possible due to the steep terrain. A model M-25 hip-chain was used to measure line lengths and position of affected areas (mortality centers). The proportion of the total line length that fell within affected areas was determined. Affected areas were determined either (1) on an individual tree basis by estimating the rooting zone of an infected tree based on its DBH, or (2) in large affected areas by noting the beginning (first symptomatic trees) and ending (last symptomatic trees) of the affected area along the transect. Trees within approximately two chains of either side of the transect were examined. Infection centers were often characterised by containing groups of windthrown trees.

Each affected area was examined for root pathogens as follows: Standing dead or symptomatic trees were examined by exposing root surfaces, the root crown cambial layer, and decayed wood. Common root rots can usually be diagnosed in the field following such an examination. Laminated root rot, caused by *Phellinus weirii*, is characterized by having ectotrophic mycelia on the exterior of infected roots along with pitted laminated decay containing setal hyphae. Armillaria root rot, caused by *Armillaria mellea*, has characteristic "mycelial fans" which replace the cambial layer on infected trees at the root collar. Decay is yellow and stringy with black zone lines. A map of the area surveyed was constructed showing location of transects and affected areas.

Results and Discussion

The 600-acre survey was completed in 3 days with a crew of two. Six transects totaling 9,934 yards (5.6 miles) were followed across the area (Figure 2). About 3 percent of the area was found to be affected by *Phellinus weirii* (Table 1). This probably represents only about half of the actual area infected since only portions with dead or windthrown trees were measured (Wallis and Bloomberg 1981). Most of the laminated root rot centers are small, scattered, and located in the lower half of the unit where Douglas-fir, the most susceptible host, predominates. Within this area, the disease usually was found on the faces of ridges, where pure Douglas-fir predominated.

Table 1--Percent of area affected by root diseases and windthrow as determined by line-intercept survey on Sauk Mountain, Washington

Line No.	Total Length (Yds)	Affected Length (Yds.) *Phellinus*	*Armillaria*	Windthrow*
1	1832	144	8	89
2	1831	134	0	0
3	1872	0	0	66
4	2450	18	0	240
5	999	0	20	492
6	950	0	0	118
Total	9934	296	28	1005
Percent		3.0	0.3	10.1

*Windthrow and mortality not associated with root diseases.

We believe that the areas affected by laminated root rot have been limited to relatively small sizes because of the presence of less susceptible hemlock and resistant cedar throughout the stand. In the upper portion of the unit where hemlock predominates, little or no laminated root rot was found.

Western hemlock is classified as intermediately susceptible to laminated root rot (Hadfield and Johnson 1977). Hemlocks may become infected, but usually they do not suffer serious damage unless growing in association with Douglas-fir. If pure stands of hemlock are planted on a site containing infected roots of Douglas-fir, some losses may occur but hemlock probably can be grown through a normal rotation without serious mortality. However, a rotation of hemlock may allow the fungus to persist on a site since hemlock roots can become infected and provide a disease pathway to Douglas-fir.

Western redcedar is classified as resistant to laminated root rot in the Douglas-fir subregion. Cedar is rarely damaged. If pure stands of cedar are grown in disease pockets, *P. weirii* will gradually die out over a normal rotation. The area we surveyed has abundant cedar, and the species is not as difficult to regenerate here as in southern Washington or Oregon.

Some red alder (*Alnus rubra*) was found in the vicinity, especially in wet areas. Alder is classified as immune to *P. weirii*. If a rotation of alder is feasible, it would be safe to replant infected sites with Douglas-fir following a minimum 40-year rotation of red alder. Some data suggest that red alder may even promote soil fungi that are antagonistic to *P. weirii* (Nelson and others 1978).

Less than 1 percent of the area was found to be affected by Armillaria root rot. This disease normally is associated with weakened or stressed trees on the West Side and is often found in association with laminated root rot. Effects of Armillaria root rot usually can be minimized by maintaining stand vigor through normal silvicultural operations and avoiding off-site planting stock during stand establishment.

Over 10 percent of the area was involved in mortality and blowdown not associated with root diseases. Most of this occurred in one large area in the upper western portion where second-growth hemlock predominated. We cannot determine exactly what killed the hemlock in this area since the mortality was at least 20 years old and most of the trees had been windthrown and deteriorated, making diagnosis almost impossible. The cause does not appear to be root diseases since extensive mortality has occurred in a relatively short period of 1 to 5 years over a large area. It is possible that repeated years of defoliation by the western hemlock looper *(Lambdina fiscellaria lugubrosa)* killed the trees. Hemlock looper has a history of destroying large acreages of hemlock.

Recommendations

The District has plans for several small timber sales over the next 20 to 30 years in the area we surveyed. We offer the following recommendations:

1. If possible, arrange cutting units where root disease is most abundant: the lower porton of the area where Douglas-fir predominates.

2. Cutting units should be intensively surveyed both (a) before logging to locate and mark disease pockets by observing blowdown and standing dead trees, and (b) after logging to refine the marked areas by noting stain and decay on freshly cut stump surfaces. FPM crews can assist the District in marking disease pockets as cutting units are established in the area.

3. Remove or destroy all Douglas-fir including all unmerchantable material from within the marked root-diseased areas.

4. Plant or retain as much cedar as possible in marked areas. Hemlock should be a second choice for regeneration if it is not possible to obtain adequate stocking with cedar.

5. Favor cedar and hemlock in diseased areas during future precommercial and commercial thinning operations.

The information and recommendations presented in this report have been specifically formulated for the area we surveyed. Although some of this information may be applied to other areas in Oregon and Washington experiencing similar root disease problems, those areas may be sufficiently different from the area we surveyed to warrant a separate biological evaluation to formulate specific management alternatives. FPM pathologists encourage and are available to perform such evaluations at the request of land managers.

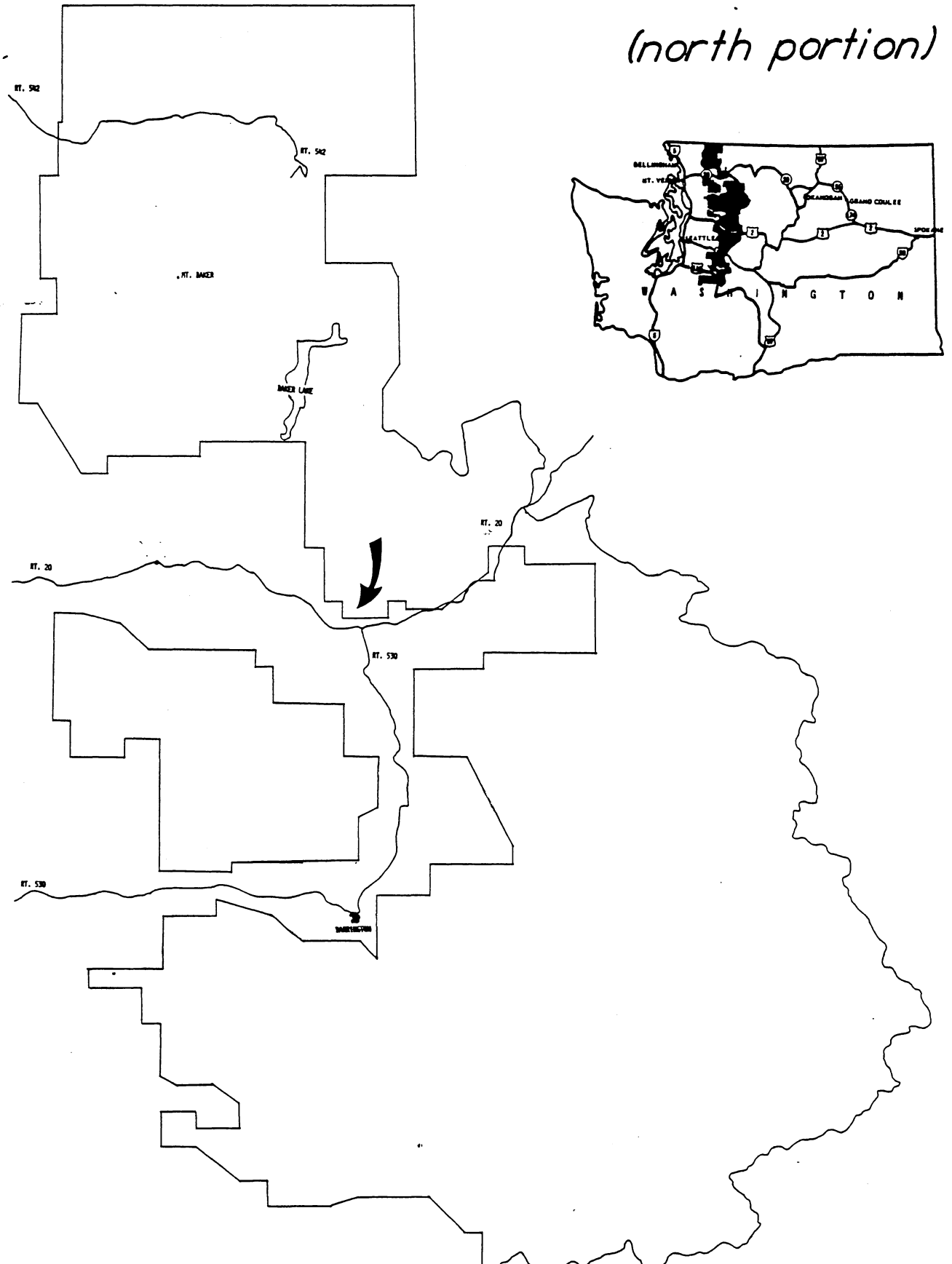
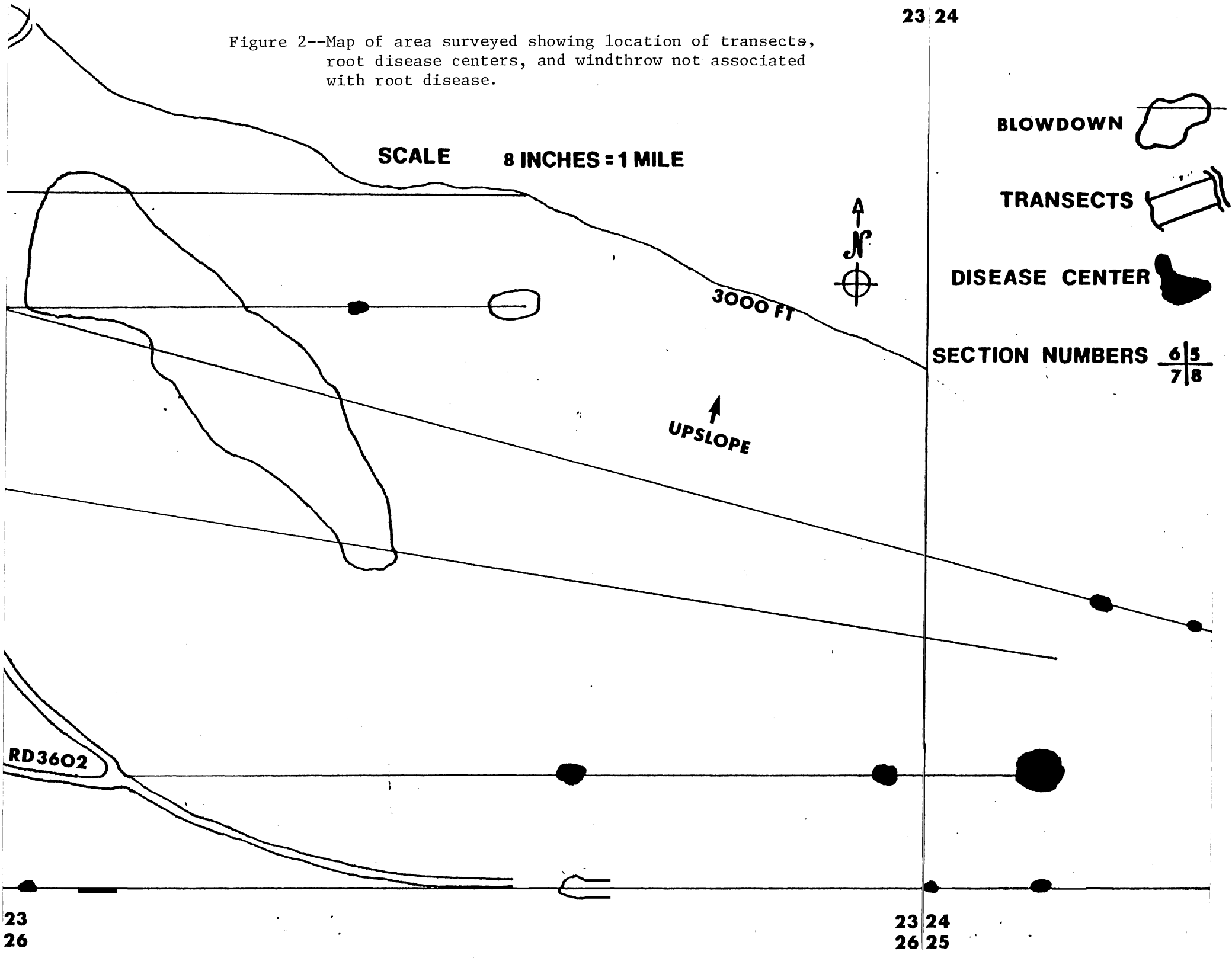


Figure 1--Map showing location (arrow) of the area surveyed on the Mt. Baker-Snoqualmie National Forest.

Figure 2--Map of area surveyed showing location of transects, root disease centers, and windthrow not associated with root disease.



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